
Logistics Management Institute

Visibility and Management
of Operating and Support Cost
Changes Needed to Support
Total Ownership Costs

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Contents

Background.....2

Research Objective.....3

Approach.....4

Observations.....5

Comparability Issues.....6

Level of Detail Mismatches.....9

Additional Data.....10

Credibility.....12

Recommendations.....14

References.....15

Abbreviations.....16

VAMOSC Changes Needed to Support TOC

Logistics Management Institute
John M. Wallace



Resource Analysis Group



This annotated briefing documents the findings and recommendations for one aspect of the research conducted by the Logistics Management Institute (LMI) for Mr. Gary Christle, Deputy Director, Program Management, Acquisition Program Integration Directorate, Office of the Under Secretary of Defense (Acquisition and Technology) (USD[A&T]API). In addition to this research, LMI provided Mr. Christle with assistance; guidance, and unbiased feedback on Total Ownership Cost (TOC) and Activity-Based Cost/Management (ABC/M) issues; assisted with the selection of a major accounting firm to develop a detailed strategic plan for encouraging the use of advanced cost management techniques (e.g., ABC/M) throughout the department; and participated on an inter-Service team (reporting to Mr. Christle) chartered to develop and define standardized activity structures needed for consistent cross-Service reporting of activity-based TOC data.

Background

- The initial focus of Total Ownership Cost (TOC) is on reducing the operating and support (O&S) costs of weapon systems.
- TOC will depend on the Visibility and Management of Operating and Support Cost (VAMOSC) system indefinitely for O&S data.
- VAMOSC Data Model was completed just as TOC initiatives started.



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Last summer, under the aegis of the Defense Systems Affordability Council (DSAC), DoD launched an initiative to reduce the TOC of the department's systems. [1] Initially, the focus of TOC will be on weapon systems, particularly the operating and support (O&S) costs of those weapon systems. Late in August 1997, the DSAC established a steering group, the Total Ownership Cost Accounting System Steering Group (TOCASSG), to investigate new accounting systems for reporting, tracking, and managing TOC. Headed by Mr. Gary Christle, USD(A&T)API, the TOCASSG is chartered to develop a strategic plan for implementing advanced cost-management information systems for reducing and managing weapon system TOC. One issue addressed by the TOCASSG is the applicability of using the Services' Visibility and Management of Operating and Support Cost (VAMOSC) reporting system for providing weapon systems O&S cost information. During briefings to the TOCASSG on January 22, 1998, the Services unanimously recommended continued reliance on VAMOSC as the primary source for weapon system O&S data. [2]

Just as the TOC initiative was starting, the OSD focal point for VAMOSC, the Office of the Secretary of Defense for Program Analysis and Evaluation (OSD [PA&E]), was completing the second phase of a functional process improvement plan designed to transition VAMOSC into an *integrated department-wide O&S cost collection and reporting system*. [3]

Research Objective

To assess VAMOSC/VIEW's capability of providing information needed by design and engineering teams attempting to reduce weapon system O&S.



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Overseeing the VAMOSC improvement effort is the VAMOSC Improvement and Enhancement Work (VIEW) group. The VIEW group primarily comprises representatives from OSD (PA&E), the Service's cost analysis communities, and the Defense Finance and Accounting Service. [4] Since members of the program management/design/engineering community are not represented on the VIEW group, we suggested to Mr. Christle (and he concurred) that LMI review the planned VAMOSC/VIEW improvements and determine if those changes would provide the information needed to support design and engineering teams attempting to reduce the O&S cost of complex military weapon systems.

Approach

- Identify what the design engineering community needs. To do so, LMI met with representatives of a major aerospace firm:
 - experienced with life-cycle cost (i.e., TOC) design tradeoffs;
 - willing to participate;
 - knowledgeable of Army, Navy, and Air Force VAMOSC; and
 - without a vested interest in VIEW.
- Cross-check those needs with a list of changes requested by NAVAIR program offices.
- Determine what the improved VAMOSC (i.e., VIEW) will provide. LMI obtained the VIEW documentation from OSD (PA&E).



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The overall approach we took is simple: find out what data the engineers need to design or redesign weapon systems to be less costly and then compare those requirements with what VAMOSC/VIEW plans to provide. Initially, our sponsor requested that we keep this research low profile until we could determine if changes to VAMOSC/VIEW were needed. To gain a sense of what information the engineering community needs, LMI met with representatives from several program offices of a major aerospace firm. We chose that company because we had worked with its representatives on other projects and knew it was competent and experienced in making TOC design tradeoffs; was willing to participate; and was experienced in performing design and engineering tradeoff studies for Army, Navy, and Air Force weapon systems (predominately aviation systems). Also, since that company did not participate in the VIEW group, it had no vested interest in the VIEW approach. After compiling a list of changes, LMI compared that list with one prepared by program offices within Naval Aviation Systems Command (NAVAIR). In general, both groups suggested the same types of changes; however, the group LMI interviewed wanted slightly more detailed information (particularly in the area of personnel resources by work centers). To identify what is planned for the improved VAMOSC, LMI reviewed copies of the *Data Requirements Package* and the *Data Model Report* published by the VAMOSC VIEW group. [3, 5] Both OSD (PA&E) VAMOSC contacts (Mr. Don Tison and Ms. Krystyna Kolesar) are new to their current positions and were not involved with VIEW activities before assuming their current positions.

Observations

- VAMOSC/VIEW is headed in right direction:
 - promoting interoperability of Service VAMOSC systems
 - improving access to data
 - improving data integrity, accuracy, and consistency.
- Some suggestions for improvements:
 - data comparability issues
 - level of detail mismatches
 - additional data items
 - credibility.



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Overall, the thinking of the contractor's engineering staff members with whom LMI spoke is very much in line with what VAMOSC/VIEW is attempting to accomplish, namely:

- ◆ promoting interoperability of Service VAMOSC systems;
- ◆ improving access to VAMOSC data; and
- ◆ improving data integrity, accuracy, and consistency.

However, on the basis of our discussions with those same individuals, we observed several areas where the VAMOSC/VIEW effort could be improved or redirected to better provide designers and engineers with data *they* need to make weapon systems less costly. We organized those research observations into the following groups and will discuss them in the following order:

- ◆ Those pertaining to improving the comparability of data from systems having different missions, operating under newly improved or different processes, or being operated by different Services
- ◆ Those pertaining to level-of-detail mismatches where the VIEW group is emphasizing one thing and the designers and engineers prefer something else
- ◆ Those pertaining to adding new items for inclusion into VAMOSC
- ◆ Those pertaining to improving the credibility of VAMOSC.

Comparability Issues

Cross-mission comparability:

- Data by equipment densities (APG-73 radar on F/A-18C/D).
- Differing operating, support, & mission environments have a significant impact on resource consumption:
 - sortie length
 - type of mission
 - duty cycles.
- Engineers & LMI agree on importance of mission differences:
 - normalizing data for different mission types
 - projecting core infrastructure requirements for wartime
 - understanding **REAL** O&S cost drivers.

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The contractor group stressed the need to make cross-mission comparisons. There are two aspects of this issue. First is an equipment-density problem in which a specific type of equipment is not installed on the entire fleet (e.g., the APG-73 radar is not installed on F/A-18C/D aircraft) or it is only installed for or operated during certain types of missions. VAMOSC computes cost-per-flying-hour and reliability statistics for all components using the total flying hours for the fleet of aircraft. As a result, engineers and analysts do not have realistic cost-per-flying-hour or reliability data for components that are not operated all the time or that are not installed on the entire fleet of aircraft.

The second issue is the different resource consumption patterns that emerge from flying different types of missions. Even for similarly equipped aircraft, the length and type of sortie flown are factors known to affect the rate at which support resources (e.g., fuel and spare parts) are consumed. [6, 7, 8, 9] The engineers would like materiel consumption data reported by type of mission (e.g., air-to-air) together with metrics, such as flying hours, sorties, and landings for each mission type. VIEW does not address this issue.

Both the engineers (particularly the reliability and maintainability engineers) and LMI consider capturing data about mission differences to be an essential step in normalizing data from different mission types; projecting core infrastructure requirements for wartime from peacetime data; and understanding the real cost drivers for O&S (e.g., flying hours is used as a cost driver for aircraft O&S costs; however, little empirical evidence indicates that flying hours are the appropriate or even the most significant cost driver. [6, 7, 9]

Comparability Issues (cont.)

- Cross-process comparability involves capturing & **tracking** the results of specific cost-reduction initiatives, such as:
 - improved design techniques (implementation of computer-aided logistics support)
 - new support concepts (2LM, O to OEM)
 - reliability improvements
 - modifications
 - alternative repair procedures.
- Capability need by TOC managers.



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In addition to mission differences, the contractor's engineers would like to see the effects that *specific* process changes, such as two-level maintenance (2LM), have on O&S costs. The costs of old and new processes now are confounded with each other in VAMOSOC reports. While the engineers want this capability for analytical reasons, TOC managers within DoD will need this capability for tracking and evaluating the effectiveness of specific TOC initiatives undertaken to reduce O&S cost (i.e., did we get what we paid for?).

VIEW does not seem to address this important issue.

Comparability Issues (cont.)

Cross-Service comparability involves reporting the cost of systems operated by active-duty, Guard, and reserve units of each Service.

- Unanimous agreement exists on the need for comparability to:
 - assess the impact of a technology introduced in one Service on another Service,
 - support joint programs where multiple Services will operate the same system, and
 - assist FMS customers plan for new weapon systems.
- Without consistent reporting, VAMOSC users need detailed visibility into standard VAMOSC reporting elements so analysts can identify reporting differences and take appropriate action.

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Within the TOCASSG the need for having comparable and consistently reported cost data across Services is still being debated; however, the group of engineers with whom LMI spoke was unanimous in its belief in the need for such data. The engineers would like the reported cost differences in each Service's VAMOSC data to reflect the actual differences between an F-16 and an F/A-18 squadron and not be confounded by differences in cost content (e.g., the F-16 reports personnel acquisition and training costs while the F/A-18 does not) or missing costs (particularly contract maintenance costs). With consistently reported data, inferences could be made about the effect a technology introduced in one Service would have in another; the likely resource impacts that joint programs would have on each Service's budget; and the likely real cost of a new weapon system to foreign military sales (FMS) customers.

While having a consistent cost content reported among the Service VAMOSC systems is a highly desirable goal, the group also recognizes the difficulty in achieving it. Until such a reporting goal is reached, the engineering group suggested that VAMOSC users be given access to a breakout of VAMOSC cost data at a low enough level of detail to identify missing VAMOSC reporting cost elements. This would enable users to quickly see what data are and are not reported by a particular Service's VAMOSC and would enable them to take appropriate corrective action.

Depending on the level of detail of the data to which users are given access, VAMOSC/VIEW appears to be addressing engineers' concerns about reporting differences among the Service's VAMOSC systems.

Level of Detail Mismatches

- The engineers were more interested in cost differences related to types of labor and skill categories required by maintenance work centers than in actual costs by SSAN.
- The engineers would like more detailed data for indirect support areas (e.g., software, sustaining eng, program management):
 - Get all of the data (both linked and nonlinked).
 - Identify key functions/activities (i.e., a WBS) for each area.
 - Relate “linked” data to components, subsystems, and end items.



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VIEW envisions capturing very detailed pay and allowance data, by social security account number (SSAN), for individuals supporting a weapon system, right down to reporting how many pounds of personal property were included in an individual's last household goods shipment. [3, 5] Instead of that type of detail by SSAN, the engineers would emphasize accurately reporting the cost differences among labor skill categories caused by turnover, rotation, specialized training requirements, and special pay (e.g., flight, hazardous duty, reenlistment bonuses, and professional pay). With that information, weapon system designers would have a better idea of where they could use technology to reduce the skill levels needed or to minimize the reliance on very expensive labor skills required to support complex weapon systems.

Both VIEW and the engineers agree on the importance of collecting the total cost of indirect support functions, such as software maintenance, sustaining engineering, and program management. VIEW plans on reporting those costs at the weapon system-level. [3] The engineers would like that data reported by a work breakdown structure (WBS) corresponding to the major activities undertaken within each function and, where reasonable, linked to the appropriate components, subsystems, or end items within a weapon system. Adjunct ABC/M studies could assist in defining the level of detail needed.

Additional Data

- GSE, ATE, and aircrew simulator O&S cost data.
- Better visibility of depot-level cost data to include the:
 - type of maintenance (overhaul, repair, ACI, modification)
 - work content (inspection, corrosion control, etc.)
 - DLR details such as:
 - repair, spares, and surcharge breakout
 - surcharge adjustments (e.g., rates, policy, and definitions).
- Financial and nonfinancial materiel data at 7-digit WUC:
 - R&M data (e.g., MTBF, MTBR, MTBMA, and false removals)
 - cycle times and inventory levels.



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The engineers also suggested that VAMOSOC be expanded to provide additional data.

They would like to expand the scope of VAMOSOC to collect and separately report O&S data for ground support equipment (GSE), automatic test equipment (ATE), and aircrew training simulators used to support weapon systems.

In addition, they would like VAMOSOC to collect and report depot-level cost data by the type of maintenance performed (e.g., overhaul, repair, analytical condition inspections, type of modifications); the work content (e.g., inspections and corrosion control) within each type of maintenance; and the breakout of DLR charges into their components (repair, replacement of condemned [washout] DLRs, and the cost recovery surcharge). Also related to DLRs, the group of engineers suggested that VAMOSOC include a repository of DLR surcharge information that can be used to adjust historical DLR information for changes in surcharge rates, pricing policy, and definitions.

For materiel items, the engineers emphasized reporting financial and non-financial data (e.g., reliability and maintainability data, cycle times, and inventory levels) at the seven-digit work unit code (WUC).

Additional Data (cont.)

- Authorized personnel (head counts) for each O- & I-level work center (O,E,C, and Skill categories):
 - Position **requires** a rated O-4 versus the position is **occupied** by a rated O-4
 - Position **authorizes** one person, but is actually **assigned** three.
- Parametric analysis data.
- Active/Guard/Reserve unit data.



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The engineers also suggest that in addition to having data on the actual staffing of a work center as VIEW would provide, they also would like information on the required or authorized staffing for each organizational and intermediate (O & I) -level maintenance work center. They want to know:

- ♦ if a position *requires* a rated (flight-qualified) officer of grade O-4, or if that position just happens to be *occupied* by a rated officer of grade O-4 and
- ♦ if a work center is *authorized* only one radar technician for a given workload, or if the personnel system has just *assigned* three.

Parametric analysis (sometimes referred to as cost-estimating relationships or CERs) is one tool that the engineers use to evaluate the impact that design changes have on cost. [8, 9] To use that tool effectively, designers need both cost and performance/technical characteristic data for items. The engineers noted that the use of CERs is limited because VAMOSOC does not collect the performance/technical characteristics. In previous research conducted for the Air Force, LMI found that the lack of (or lack of access to) performance/technical characteristics is a significant obstacle to developing meaningful CERs for O&S costs. [9] VAMOSOC/VIEW does not address this issue.

The engineers also would like to see differences among the cost of weapon systems operated by the active-duty, Guard, and reserve forces.

Credibility

- Unexplained differences between VAMOSC and known benchmarks undermine VAMOSC's credibility as a valid source of O&S data for TOC:
 - External benchmarks, such as actual budget expenditures, detailed analytical estimates, and other data reporting systems (e.g., R&M), do not agree with VAMOSC reports.
 - Internal benchmarks, such as material costs reported in the MDS-level and WUC-level VAMOSC products, do not agree.
- The engineers suggest a reconciliation of VAMOSC to known benchmarks be available so that users know "what is included in VAMOSC and what is not."

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Improved credibility is one objective of VIEW; however, VAMOSC's credibility was such a hot-button issue with the engineers that we interviewed that we decided to include a summary of their concerns in this briefing.

VAMOSC is not intended to capture all costs; however, according to the group of engineers with whom LMI spoke, that simple fact tends to undermine the credibility of VAMOSC when comparisons are made to other known benchmarks (external ones such as actual budgetary expenditures, detailed engineering analyses, and other data [e.g., reliability and maintainability [R&M] reporting systems) and the differences cannot be explained. The engineers also pointed out that internal reporting differences in VAMOSC itself also undermine its credibility. For example, summing the material costs in the mission design series (MDS) (weapon system) -level VAMOSC report seldom adds up to the material costs reported in the WUC component-level detail VAMOSC report.

The group of engineers suggested that a reconciliation be available to users so that they would know what is included in VAMOSC as well as what is not.

Credibility (cont.)

- Provide better documentation that:
 - defines without codes
 - explains the entire data collection process, and
 - documents changes affecting comparability of data between years.
- Ensure validation of VAMOSC data:
 - data reported is correct
 - all relevant data are collected.
- Enable VAMOSC users (especially contractors) with:
 - In-depth training for new users
 - Easier and timelier access to the VAMOSC data base.



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The engineers had other suggestions to improve VAMOSC's credibility. First, they would like better documentation. Most VAMOSC data elements already are defined to some extent; however, the definitions themselves often contain references to undefined codes that make the definition itself incomprehensible. In addition to better definitions, the engineers felt that a complete explanation of how each data element is processed within VAMOSC (from the source document to the VAMOSC number reported) would enable users to better understand and help them explain to their management and customers how VAMOSC numbers are computed. Also, because many changes occurring over time will affect the comparability of VAMOSC data, the engineers requested a summary of changes occurring each year and the effect each change (such as new source data systems, new VAMOSC processing, or changes to definitions or content, particularly on the DLR surcharge) has on reported costs.

Second, they stressed the importance of having a process in place to ensure the validity of VAMOSC data. Their concern was twofold: (1) that the data in VAMOSC is *correct* and (2) that VAMOSC has collected all the *relevant* data. The latter point pertains to the problems associated with changing data systems and dynamic operational situations (e.g., Desert Storm) where valid data get reported via nonstandard methods.

Finally, the engineers requested (almost pleaded for): (1) in-depth VAMOSC training (particularly on the definitions and the processing and flow of data within VAMOSC) and (2) easier and timelier access to the VAMOSC data base (commenting that it takes too long for contractors to get approval and access to VAMOSC data for it to be useful in meeting project deadlines).

Recommendations

VAMOSC/VIEW should investigate the feasibility of incorporating O&S data needed by designers and engineers into VAMOSC.

Expand LMI's analysis into other platforms (e.g., ships and tracked vehicles) to identify data requirements unique to those types of weapon systems.



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In summary, some information identified by the engineers and designers have not been addressed by planned VAMOSC enhancements. Therefore, LMI makes two recommendations:

- ◆ First, the VAMOSC/VIEW team should study the feasibility of incorporating into VAMOSC the data that engineers and designers need to reduce the TOC of military weapon systems.
- ◆ Second, since the specific observations discussed in this briefing were obtained from discussions with engineers and designers familiar with aeronautical systems, we recommend that LMI's analysis be expanded to other platforms (such as ships and tracked vehicles) to identify TOC data requirements unique to other types of weapon systems.

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Abbreviations

2LM	Two-level Maintenance
ABC/M	Activity-Based Cost/Management
ATE	Automatic Test Equipment
CER	Cost Estimating Relationship
DSAC	Defense Systems Affordability Council
FMS	Foreign Military Sales
GSE	Ground Support Equipment
NAVAIR	Naval Aviation Systems Command
O&I	Organizational and Intermediate
O&S	Operating and Support
OSD(PA&E)	Office of the Secretary of Defense for Program Analysis and Evaluation
R&M	Reliability and Maintainability
SSAN	Social Security Account Number
TOC	Total Ownership Cost
TOCASSG	Total Ownership Cost Accounting System Steering Group
USD(A&T)API	Under Secretary of Defense (Acquisition and Technology) Acquisition Program Integration
VAMOSC	Visibility and Management of Operating and Support Cost
VAMOSC/VIEW	VAMOSC Improvement and Enhancement Work
WUC	Work Unit Code

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